ENERGY ASSURANCE TECHNOLOGIES

Project Fact Sheet

Advanced Sensor System for Energy Infrastructure Assurance

Benefits

- A combined shock and hydrocarbon sensor maximizes detection of possible events such as impacts resulting in a sudden release of hydrocarbons and other transients
- Wireless communication links eliminate the need for hard wired sensors and their associated installation and maintenance costs
- Remote monitoring minimizes response time to detected events and potentially reduces the need for routine human monitoring
- Sensors with on-board power (battery integrated with a renewable power source) and low power consumption requires infrequent operator intervention
- Continuous computerized monitoring increases assurance of the monitored energy assets

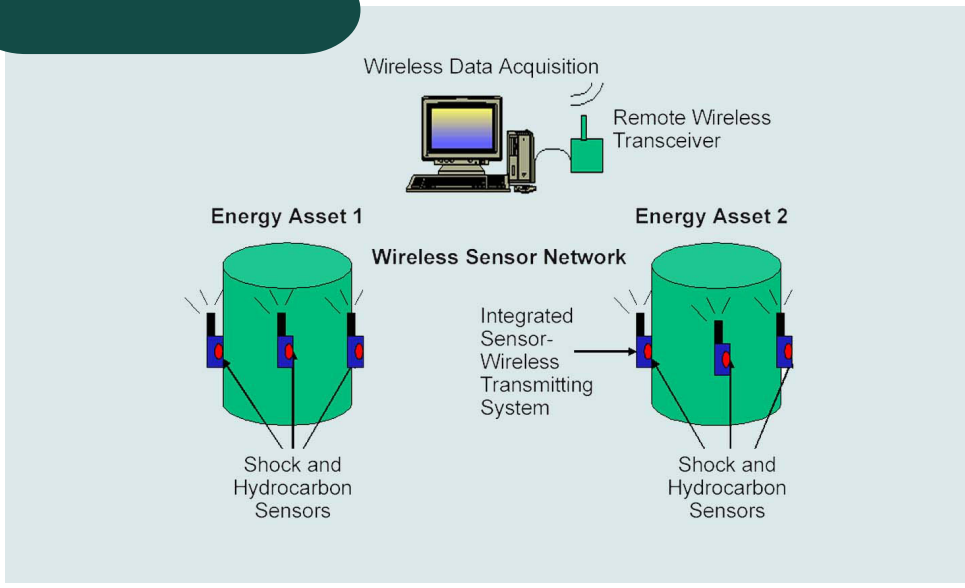
Applications

The integrated wireless sensing system will be designed to detect severe shocks and leaks of hydrocarbons as a result of breaches caused by high energy impacts and to alert facility personnel. This system can be installed in any facility that contains substantial amounts of hydrocarbons, particularly in storage tanks, where early detection of a leak is important. This includes refineries, gasoline, heating oil, and diesel storage facilities and energy infrastructure transport facilities. Since the wireless system is designed to be modular, it is anticipated that it will be easily adaptable to other sensing applications by replacing the sensor modules. This should also make the concept valuable to sensing applications in other industries, such as the chemical industry, where rapid detection of leaks at storage or process facilities is a high priority.

An integrated wireless sensor system will enable remote continuous monitoring of energy storage facilities to detect breaches from various causes

Significant quantities of energy assets including heating oil, diesel fuel, and gasoline are stored and transported within the United States and constitute a vital part of the energy infrastructure. Energy asset storage tanks are potentially vulnerable to malicious acts from a remote location with potential serious consequences including fire, explosion, environmental damage, potential loss of life, and economic losses due to release of materials and damage to infrastructure. This project addresses development and demonstration of a wireless sensor technology that aids in the early detection of damage due to such an act. Prompt detection will enable a rapid response, mitigate the adverse impact of such an event, and, hence, aid in protecting the U.S. energy infrastructure.

The project approach to developing this system involves integration of a shock sensor and a hydrocarbon sensor with a wireless communication system, and an on-board power source rechargeable through solar power. The best and most appropriate technology for each of these components will be chosen from those available commercially or from those under development at Oak Ridge National Laboratory (ORNL).



The unique sensor technology enables remote early detection of energy asset (e.g. storage tank) breaches by wireless transmission of sensor data from each asset to a remote central location

Project Description

The project will develop and demonstrate a sensor system that would enable early detection of hydrocarbon leaks from breaches to the energy infrastructure, thereby minimizing the operational and economic consequences of such events.

Specifically, the project will develop and demonstrate a wireless sensing system to detect a breach in storage tanks. The sensing system works by detecting both an impact through a shock sensor and by measuring hydrocarbon levels in the vicinity of the tank. The measured hydrocarbon levels are then compared with average levels for that location. If abnormal levels are detected, this information will then be transmitted on a real time basis to a remote operator (such as in a control room) who could respond rapidly to minimize potential losses and consequential damage to personnel and property. The project will initially focus on examining the feasibility of developing a system that can be rapidly deployed in energy storage tank locations using commercially available technologies for shock sensing, hydrocarbon sensing, and wireless communications. Technologies developed at ORNL for sensing and sensor wireless communications will be utilized if demanded by the sensitivity and range requirements for the application.

Progress and Milestones

This project includes the following milestones:

- Survey available shock and hydrocarbon sensors, along with commercially available wireless technologies (2Q/04)
- Down-select initial shock and hydrocarbon sensors from those commercially available and from those developed at ORNL with laboratory verified performance to meet project goals (4Q/04)
- Modify and initiate field-testing of transmitter and receiver systems for wireless monitoring of the down-selected sensors (3Q/04)
- Complete assembly and initiate first field-testing of the combined wireless shock and hydrocarbon sensor system (2Q/05)
- Complete system validation and testing by conducting a system demonstration at an appropriate energy sector facility (4Q/05)

Economics and Commercial Potential

The economic value of storage tanks for petroleum products in the U.S. is very significant. An API survey conducted in 1989 estimated the total number of such tanks in the U.S. at 700,000, inclusive of refining, marketing, transportation, and production. These storage tanks represented a capital asset of about $700 billion and more than 2 billion barrels of energy-related materials, with an estimated value of over $60 billion. Prompt detection of adverse events impacting these assets will not only result in direct economic benefits through minimizing loss of materials and damage to the infrastructure, but will also prevent indirect losses through loss of productivity.

Although hydrocarbon sensors are currently used in storage facilities, these are hard-wired sensors. The sensor technology being developed in this project has a significant market potential since it represents state-of-the art in shock and hydrocarbon detection. In addition, it will be wireless-enabled with a renewable power source that can be charged through solar power. It is anticipated that the advantages inherent in the system being developed will result in substantial commercial benefits through replacement of existing sensors and through incorporation into future installations. The complete sensor system will be commercialized through project partner(s) already actively involved in the industrial sensors sector.

Project Partners

Oak Ridge National Laboratory
Oak Ridge, TN

Pegasus Technologies, Inc.
Lenoir City, TN

Konarka Technologies, Inc.
Lowell, MA

Delphian Corporation
Northvale, NJ

Materials Technology Institute
St. Louis, MO

Interested in joining the partnership, being informed of outcomes, or being a demonstration site? Contact:

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